

IN THE SPECIFICATION:

Please replace [0019] with the following amended paragraph:

[0019] As shown in Figs. 1 and 2, the IC device 3 has adhesive bodies 45 located at the corners 23 of the device that form connections, generally indicated 51, between the IC device and the substrate 7 to mechanically connect the IC device to the substrate [[7]]. The adhesive bodies 45 are positioned between the IC device 3 and the substrate 7 in contact with the flat bottom surface 11 and side surfaces 15 of the IC device. The adhesive bodies 45 are located on the periphery of the IC device 3 after the solder spheres 35 have been positioned to electrically connect the IC device to the substrate 7. In the illustrated embodiment, the adhesive bodies 45 are discrete spheres of adhesive material but it will be understood that the bodies could have other shapes and sizes. As shown in Fig. 2, the adhesive bodies 45 may be positioned at the corners 23 of the IC device 3 to mechanically connect the circuit device to the substrate 7. As shown in Fig. 3, the adhesive bodies 45 could also be placed between the IC device 3 and the substrate 7 at locations along the edges of the device between adjacent corners 23 of the device. Although, the adhesive bodies 45 are shown in Fig. 3 as being approximately equidistant from adjacent corners 23 of the IC device 3, it will be understood that the adhesive bodies 45 could be otherwise positioned on or near the peripheral edge of the circuit device and that additional adhesive bodies could be placed between the IC device and the substrate.

Please replace [0020] with the following amended paragraph:

[0020] In the illustrated embodiments, the adhesive bodies 45 are located adjacent the peripheral edge of the flat bottom surface 11 of the IC device 3 so that the bodies contact both the

bottom surface and the flat side surface(s) 15 of the IC device. Positioning the adhesive bodies 45 in contact with both the flat bottom surface 11 and at least one side surface 15 enhances the mechanical holding force of the ~~bodies~~ connections 51.

Alternatively, the adhesive bodies 45 could be spaced in from the side surfaces 15 of the IC device 3 so that the bodies only contact the flat bottom surface 11 of the device. Further, the adhesive bodies 45 could be located at any location on the bottom surface 11 of the IC device without departing from the scope of this invention.

Please replace [0021] with the following amended paragraph:

[0021] The adhesive bodies 45 of the present invention comprise a non-thermosetting polymer material that allows a releasable connection between the IC device 3 and the substrate 7. In one particular embodiment, each adhesive body 45 comprises a thermoplastic polymer that has been formed into discrete spheres of material. The thermoplastic material of the adhesive body 45 is desirably a high molecular weight polymer that has the unique capability of softening or re-melting when heated and returning to a solid when cooled. Upon placement between the circuit device 3 and the substrate 7, each adhesive body is heated to soften or melt and adhere to the IC device and substrate. Upon cooling, the adhesive body 45 solidifies to form a joint in the form of connection 51 that mechanically attaches the IC device 3 to the substrate 7. The adhesive body 45 can be reheated to soften or melt the body to release the ~~mechanical~~ connection 51 and allow the IC device 3 to be readily removed, repaired and replaced using the same adhesive bodies or new bodies. In this way, the adhesive bodies 45 of the present invention each provide a releasable connection 51 between the IC device 3 and the substrate 7. The releasable ~~connection allows~~

connections 51 allow defective IC devices 3 discovered during final testing of the completed electrical circuit assemblies 1 to be easily replaced on the substrate 7 (e.g., circuit board) without damage to the substrate or other components.

Please replace [0022] with the following amended paragraph:

[0022] In one embodiment, the adhesive bodies 45 comprise a thermoplastic polymer commonly sold under the trade name STAYSTIK® by Cookson Electronics of Alpharetta, Georgia. Reference may be made to U.S. Patent Nos. 5,061,549 and 5,401,536, both of which are incorporated by reference herein for all purposes, for additional information regarding STAYSTIK® thermoplastic adhesives. The adhesive bodies 45 could comprise other thermoplastics (e.g., polysulfones) that may include a small amount (e.g., about 1% to 5% by weight) of carbon black to absorb infrared and near-infrared radiation and improve strength. The adhesive bodies 45 can comprise any thermoplastic capable of melting and bonding to the IC device 3 and the substrate 7. Wetting agents and strength boosters can be added to reduce the coefficient of thermal expansion of the bodies 45 to match that of the solder spheres 35, thus reducing thermal stress on the connection between the IC device 3 and the substrate 7. The adhesive bodies 45 could comprise a core material that is coated with an outer adhesive layer or adhesion primer. The bodies 45 could comprise a B-stage adhesive (e.g., epoxy) that melts before polymerizing so as to bond to the IC device 3 and substrate 7. If a B-stage adhesive is used, the adhesive bodies 45 would have increased bond strength but the ~~mechanical connection~~ connections 51 between the IC device 3 and the substrate 7 would be more difficult to release.

Please replace [0027] with the following amended paragraph:

[0027] With either the gravity feed mechanism 65 or the jetting mechanism 101, the adhesive bodies 45 may be preheated before placement between the IC device 3 and the substrate 7 or the bodies may be heated as they exit the mechanism so that assembly time is reduced. Preferably, the gravity feed mechanism 65 and jetting mechanism 101 are components of a programmable machine (not shown) that may be used to automatically and precisely place each adhesive body 45 and apply the exact amount of heat to the body for the required bonding time of the specific adhesive body used. The jetting mechanism 101 may be similar to the jet soldering system disclosed in U.S. Patent No. 6,276,589, incorporated by reference herein for all purposes, in that the adhesive bodies 45 may be molten plastic that is directed to the bond site between the IC device 3 and substrate 7. The gravity feed mechanism 65 or jetting mechanism 101 may be designed to extract the adhesive bodies 45 from the electrical circuit assembly 1 by applying heat to release the ~~mechanical~~ connection 51 between the IC device 3 and the substrate 7 and using vacuum pressure to extract each adhesive body.

Please replace [0028] with the following amended paragraph:

[0028] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained. The adhesive bodies 45 of the electrical circuit assembly 1 establish a releasable ~~mechanical~~ connection 51 between the IC device 3 and the substrate 7 that provides sufficient mechanical holding force for reliable operation of the circuit assembly. The adhesive bodies 45 comprise ~~a non-thermosetting material~~ that allows ~~[[the]]~~ each ~~mechanical~~ connection 51 to be formed by the quick application of localized heating to the adhesive bodies. The ~~connection~~ connections 51 can be released by reheating the adhesive bodies

45 allowing the IC device 3 to be easily removed, repaired and/or replaced.